DISTRIBUTED COMPUTER SYSTEMS ARCHITECTURE

CSCI/CSIS 604, Section 81/90
Fall Semester 2014
Tuesday, 6:00-8:30 p.m., TBD at Harbor Walk East 334

Instructor

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Office Hours

Wednesday, 5:00-6:00 p.m. at Harbor Walk East
Other times by appointment, or any time my door is open.

Course Description

This course covers basic techniques for the design and construction of distributed systems. Its aim is to give the skills needed to build simple systems and to identify key issues for the analysis of distribution problems.

Prerequisite: None.

Course Objectives

This course:

- Introduces a student to problem-solving with distributed computing systems
- Introduces a student to design and implementation issues, including coding
- Lays the groundwork for further advanced study in the Master's Program in areas such as systems, networking or enterprise integration

Course Outcomes

By the end of the course, a student can:

- Design and build simple distributed systems using modern tools
- Identify analyze and discuss key issues, problems and technologies relating to designing and constructing distributed computing systems

Textbook

Coulouris, Dollimore, Kindberg, Blair, Distributed Systems: Concepts and Design, 5th Ed., Pearson Education, Inc., as Addison-Wesley, 2012. ISBN 13: 978-0-13-214301-1

General Plan

Lectures will introduce each key topics. You will be expected to go deeper in your reading, class preparation, questions, and work outside of class. You should come to class prepared to answer questions, and understand that the instructor is not going to feed you everything you are expected to know and learn. Over the course of the semester, you will complete 7 "unit sheets", due approximately every two weeks, and a research paper. These unit sheets combine aspects of homework and exams in a format that gives you some choice, so there are no exams in the traditional sense. See more information below.

Grading

You are not competing against anyone else for a grade, and it is possible to everyone in the class to get an "A" or to get an "F". You should focus on upgrading your skills and knowledge, not looking for a grade. Your grade will be based on the following items:

Item	Points	Percentage
Unit Sheets	700	75%
Research Project	233	25%

Your grade is determined by adding your scores together and dividing by points possible. In assigning the final grade, the instructor may consider factors such as attendance, participation growth and development as well as performance, with an emphasis on performance. Grades for the course follow the Graduate Catalog:

F indicates that even minimal requirements have not been met.
C is below average, but passing, indicating unsatisfactory graduate work.
C+ indicates slightly below-average graduate work.
B indicates average graduate work.
B+ indicates above-average quality work.
A indicates high-quality work.

Individual assignments will be graded on this same scale, using criteria that will be given in class. Grading for the units is done using a layered curriculum. Each unit has a "C" layer, a "B" layer, and an "A" layer, which are explained below.

Absences

A student who misses 20% (6 hours) or more of classes may fail the course, *at the discretion of the instructor*. Extenuating circumstances will be taken into account when making this determination. If your job is going to require you to be excessively absent, you may not want to take this course.

Exams & Homework

As mentioned, there are no exams in the typical sense. Instead, you are given a series of unit sheets. A unit sheet normally includes questions that you might encounter on a typical exam, lab-type questions that require empirical answers, theory questions and opinion questions. It is expected that you will do some work toward completing the currently assigned unit sheet every day. You may expect to spend an average of 6 hours per week reading, preparing and completing assigned work outside of class.

The questions for each unit are broadly grouped into three “layers”. Within each layer, you may choose from a group which questions to answer when given a choice. The total number of points possible on each unit is 100.

"C" layer helps you learn general information, basic concepts and the “vocabulary” of a given topic. You will choose "C" layer questions you want to answer, complete the work, and then be prepared to demonstrate learning by oral defense. Oral defense means you may have to answer questions about your work asked by the instructor.

"B" is designed to help you apply information from the "C" layer, discover something, hypothesize or problem solve. “B” layer questions can often be formulated as experiments. Normally, you would choose two questions to work on in the "B" layer.

The "A" layer requires you to analyze an issue, research facts and form an opinion--critical analysis. Normally, you choose one question from the "A" layer.

Each 5 points on a question normally represents about 20 minutes of work. Rubrics for each kind of question will be available so that you know various kinds of answers will be graded.

Research Project

You will be expected to research a topic of interest to you in distributed systems. You will be expected to give a presentation and a written report on the topic. A handout on the project details is posted here. This semester, your instructor has two particular research projects that may be of interest to you. Enquire in class for further details.

Participation in Class

"Skilled Participation" means that

- you have read and studied assigned reading material
- you are prepared to discuss the material intelligently
- you are prepared to ask and answer questions on the topic of the day
- you actively and constructively participate in class and follow instructions

Dates & Topics

The information given here may change at the discretion of the instructor.

Dates	**Event**
Aug. 27	1st Day of class; Ch 1 Characterize Dist. Systems
Sep. 3	Ch 2 Syst. Models
Sep. 10	Ch 3 Networking, Internetworking
Sep. 17	Ch 4 Interprocess Communication
Sep. 24	Ch 5 Remote Invocation
Sep. 31	Ch 6 Indirect Comm. Research Proposal Due
Oct. 1	Ch 7 OS Support
Oct.8	Ch 9 Web Services
Oct. 15	Ch 11 Security
Oct. 22	Ch 12 Dist. File Systems
Oct. 29	Ch15 Coordination & Agreement
Nov. 5	CH 16 Transactions & Concurrency Control
Nov. 12	Ch 18 Replication
Nov. 19	Ch 19 Mobile & Ubiquitous Computing
Nov. 26	Research Report Due **Thanksgiving Break – No Class**
Dec. 3	Project Presentations
Dec. 10	Project Presentations

Units

Below is a list of the 7 major units we will be covering this semester. Roughly speaking these units correspond to groups of two chapters in your text. Each unit has a corresponding Unit Sheet that lists possible assignments, point values and due dates.

Unit 1: Models of Computation Unit Sheet
In this unit we:

- Define key terms and concepts
- Discuss examples of distributed and parallel systems
- Discuss broad trends and challenges
- Discuss models for distributed and parallel computation
- Technical Writing

Unit 2: Networking and Interprocess Communication Unit Sheet

In this unit we discuss:

- Types of networks
- Networking and Internetworking
- Network principles and protocols
- Data representation and marshaling
- Multicasting
- Network virtualization and overlays

Unit 3: Remote Invocation and Publish-Subscribe Communication Unit Sheet
In this unit we discuss:

- Request-Response protocols
- RPC
- RMI (general)
- Groups
- Publish-Subscribe
- Message Queues
- Shared memory approaches

Unit 4: OS Services and Web Services Unit Sheet
In this unit we discuss:

- OS layer
- Processes and Threads
- OS communication and Invocation
- OS Architecture
- OS-level virtualization
- Web Services
- IDL/XML Service Descriptions
- Coordination of Services

Unit 5: Security and Distributed File Systems Unit Sheet
In this unit we discuss:

- Security techniques
- Cryptographic algorithms
- Digital signatures
- File Services, with case studies

Unit 6: Coordination, Agreement, Concurrency Control Unit Sheet
In this unit we discuss:

- Impossibility of Consensus
- Distributed Mutual Exclusion
- Elections
- Coordination and Agreement among members of a group
- Transactions
- Locks
- Concurrency control
- Timestamp Ordering

Unit 7: Replication and Mobile, Ubiquitous Computing Unit Sheet
In this unit we discuss:

- Models
- Fault-tolerance
- High-availability and performance
- Transactions with replicated data
- Association
- Interoperation
- Sensing and Context-awareness
- Security, Privacy and Adaptation

Rubrics

How do I do...

General rubrics listed here are taken from the book "Layered Curriculum" by Kathie F. Nunley. Others are my creation, but didn't just spring from the ether.

Flash Cards

You may either buy index cards or make flash cards form regular white 8.5"x11" white paper. Fold one sheet of paper in half three times to make 8 squares and cut along the fold lines. Use 2 or 3 pieces of paper, enough for the number of terms. Write the word on one side, and the definition in your own words on the other. Learn them. They are worth 10 points.

Grading: I will choose 10 cards at random and ask you about those words. You get 1 point for each question you get correct.

Artwork

Artwork involves posters and models. Generally, they are worth 10 points. Be creative. Artistic ability counts in the grade. Note: Mock-up User interfaces, and engineering diagrams are in a different category than artwork.

Grading: I will ask you 5 things you learned about the project. Points are based on artistic value and learning.

Miscellaneous Reading

You may read for 45 minutes on a course-related topic in newspapers, magazines, books, etc. Please tell me beforehand what topic you are reading on. Upon completion, I will ask you to tell me about your reading.

Grading: Your summary is worth 10 points based on enthusiasm and information gained from the reading. You should be able to explain and defend 5 things you learned from the reading.

Labs

Labs include any "B" level questions, including what we traditionally think of as labs and any question in which you must design a procedure to solve your problem. Choose one of the following ways to present your results:

1. Lab report
   A written summary that includes what question you are trying to answer, your hypothesis, details of the procedure you used, what happened and your conclusions.

2. Lab Display
   Using a piece of paper or a computer model, draw or illustrate what happened in your lab. Make sure the question is on display and that we can see the results and your conclusions.

3. Lab Verbal Report
   Prepare a 5-10 minute report containing the information as specified for a Lab Report above. Give the report in person, or record it on video and post the video on your website or youtube, or somewhere accessible to me.

"A" Level Assignments

Choose an "A" level question. Go to the library (or use a scientific search engine) and find at least 3 recent journal or magazine articles on your topic. Recent normally means less than 5 years old.

Your write-up has 2 main parts. First, summarize the main points of each article. Second, write a good 2- or 3- paragraph summary of your opinion on the topic. As a

rule of thumb, a good paragraph contains 5-7 sentences, and has a clear main point. Make sure you cite your research when stating your opinion. Get help from a librarian on finding good sources if you need it. "A"-level assignments are worth 20 points.

General Comments about Papers, etc.

When doing "A" level assignments, essays and papers, follow an IEEE or an ACM template or style guide for conference papers when questions arise that are not specifically answered or understood from your instructions. For writing your research paper, ACM SIG templates are here; IEEE templates are here. Papers should be written in single-column mode.

Watching Videos (Youtube, etc.)

Videos are generally worth 15 points for each 45-60 minutes you watch. To get points, you must pay attention and watch during the required minutes. If you are using sites such as youtube, this may require that you watch a number of videos on a topic. 10 points are given for watching, and up to 5 points for you answering 5 questions I ask about what you've learned.